

Gender Differences in the Microanatomy of Skin of Palm in Humans.

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Received: February 2019

Accepted: February 2019

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ABSTRACT

Background: Knowledge of basic elements provides opportunity to make clear vision of structure of any organ. It is well known that accurate values of thickness of epidermis of skin and its variation with body site, age and sex are important in the fields of medical and biological research. The variations in skin reaction to certain stimuli could be due to biological factors such as the epidermal thickness, dermal thickness, distribution of epidermal appendages etc. **Methods:** Skin was procured from palm of six freshly embalmed human cadavers. Out of these three were males and three were females. Age of the male and female cadavers ranged between 60 to 70 years (mean age 67 years). Skin samples measuring 1 cm (L) X 0.5 cm (B) were taken from center of palm. Tissue was preserved in 10% formaldehyde for 48 hours. Fixed tissue specimens were dehydrated through increasing concentrations (30%, 50%, 70%, 90% and absolute) of ethanol. After clearing the tissue in xylene, embedding was done in paraffin wax. 5 µm thick sections were cut using rotary microtome. Whole thickness of tissue was sectioned. Haematoxylin[Harris's] and Eosin stained section was observed for 3 different fields thus for each cadaver 27 observations were obtained. **Results:** In females thickness of epidermis(Edp) of were observed $404.43 \pm 23.41 \mu\text{m}$, thickness of stratum corneum ($330 \pm 32.83 \mu\text{m}$), layers of stratum spinosum, stratum granulosum were 4 and 3 respectively, number of rete pegs (7.52 ± 0.94), depth of rete pegs ($195.78 \pm 18.05 \mu\text{m}$), thickness of papillary dermis and reticular dermis were ($135.92 \pm 13.230 \mu\text{m}$) and ($386.10 \pm 8.24 \mu\text{m}$) respectively. Whereas In males thickness of epidermis(Edp) of were observed ($296.63 \pm 107.03 \mu\text{m}$), thickness of stratum corneum were ($112.20 \pm 63.92 \mu\text{m}$), layers of stratum spinosum and stratum granulosum were 2, number of rete pegs 16.15 ± 3.71 , depth of rete pegs ($104.56 \pm 15.28 \mu\text{m}$), thickness of papillary dermis and reticular dermis were ($142.63 \pm 40.84 \mu\text{m}$) and ($483.27 \pm 116.43 \mu\text{m}$) respectively. **Conclusion:** Despite of the fact that subjects from both sexes belonged to the same age group, clear and statistically significant histological differences were observed in the skin of palm. Females showed thicker epidermis as well as stratum corneum but thinner dermis in comparison to males. Males had more number of rete pegs but these are shallower than females.

Keywords: Palm, epidermis, stratum corneum, rete pegs, thickness.

INTRODUCTION

Skin is one of the visible and largest organs of the body and ensheathes all other organ.^[1] It protects against various external physical, chemical, and

biological assailants, as well as prevents excess water loss from body.^[2] Variations in skin reaction depends upon its epidermal and dermal thickness, and distribution of epidermal appendages.^[3] Accurate values of thickness of epidermis of skin and its variation with body site, age and sex are important in the fields of medical and biological research.

A wide variety of agents encountered in the workplace may cause injury, irritation, sensitization, infection or discoloration in the skin of the exposed worker. Some agents even can induce cancerous changes in the skin.^[4] Variations

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in thickness of skin can affect absorption of ionizing radiations. This is particularly important in nuclear power industry where dose to basal layer of skin (deepest epidermal layer) can set limit on time, during which operators are allowed to perform work. Diffusion of a radioactively labeled compound occurs through epidermis and dermis into blood vascular system of living subjects. Hence, it is essential to have values of epidermal thickness so that measurements can be interpreted in terms of dose to basal layer. Protective measures against exposure of radioactive components are dependent on skin thickness of various exposed parts. In absence of quantitative data, some parts which are thick may unnecessarily protected or vice versa.^[3]

Several studies have been performed regarding various parameters of normal skin, both from cadaveric skin and from living healthy volunteers.^[3,5-7] Data is also available stating the histological changes in skin with advancing age but a clear lacuna is seen in the documentation of differences in the histological features of skin of palm of human male and female.^[8-10] Therefore, the present study was carried out to formulate a basic background of differences which can set a standard to compare pathological and chronological changes.

MATERIALS AND METHODS

After obtaining the ethical clearance from Institutional Ethics Committee, skin was procured from palm of six freshly embalmed human cadavers. Out of these three were males and three were females. Age of the male and female cadavers ranged between 60 to 70 years (mean age 67 years). Skin samples measuring 1cm (L) X 0.5cm (B) were taken from center of palm. Tissue was preserved in 10% formaldehyde for 48 hours.

Fixed tissue specimens were dehydrated through increasing concentrations (30%, 50%, 70%, 90% and absolute) of ethanol. After clearing the tissue in xylene, embedding was done in paraffin wax. 5 µm thick sections were cut using rotary microtome. Whole thickness of tissue was sectioned. Three regions, each containing 3 sections were chosen at the interval of 20 sections. Thus, for each site of each cadaver 3 slides were prepared. Hence, 3 slides were containing total 9 sections of each tissues from each cadaver. Slides were stained by Haematoxylin [Harris's] and Eosin stain. Each stained section was observed for 3 different fields thus for each cadaver 27 observations were obtained.

Following 8 quantitative parameters were observed for each slide :

- Thickness of epidermis at dermal papilla (Edp)
- Thickness of stratum corneum (Tsc)

- Number of layers of stratum spinosum at dermal papilla (ss)
- Number of layers of stratum granulosum at dermal papilla (sg)
- Depth of rete pegs (Drp)
- Number of rete pegs (rp)
- Thickness of papillary dermis (Tpd)
- Thickness of reticular dermis (Trd)

The thickness of above mentioned parameters were measured with the help of ERMA's micrometer. Value of each parameter in micrometer was entered into word excel sheet. For each parameter 9 values were taken and the mean value was calculated. The values were represented in Number and Mean±SD. The mean value of each parameter were compared for gender wise changes by using student t test and Mann-Whitney test. P value less than 0.01 was considered highly significant. The statistical analysis was done using SPSS (Statistical Package for Social Sciences) Version 21.0 statistical Analysis Software. The microphotography was done with the help of device incorporated with software easy capture U S B 2.0 high quality video and audio.

RESULTS

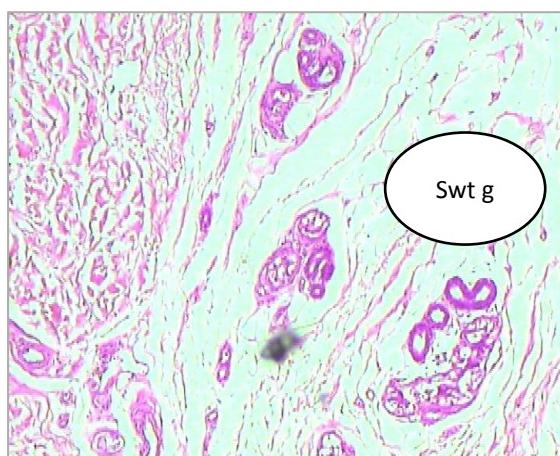
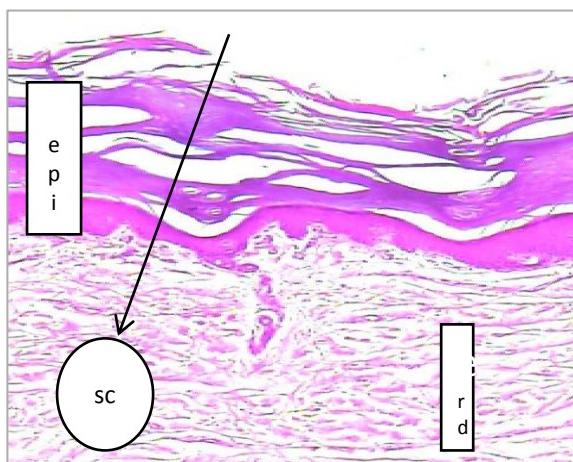
Table 1: Gender wise comparison of various skin parameters from Palm Region

	Female (n=27)		Male (n=27)		Statistical significance	
	Mean(µm) (Median)	SD	Mean(µm) (Median)	SD	't'/ Z	'p'
Thickness of epidermis (Edp)	404.43	23.41	296.63	107.03	5.113	<0.001
Thickness of stratum corneum(s c)	330.00	32.83	112.20	63.92	15.748	<0.001
Sc:Edp	0.814	0.039	0.431	0.333	5.952	<0.001
Layers of stratum spinosum(ss)*	4.41 (4.00)	0.50	2.48 (2.00)	0.51	-6.523	<0.001
Layers of stratum granulosum(sg)*	3.33 (3.00)	0.48	2.00	0.68	-5.710	<0.001
Number of rete pegs	7.52	0.94	16.15	3.71	-11.727	<0.001
Depth of rete pegs	195.78	18.05	104.56	15.28	20.049	<0.001
Thickness of papillary dermis	135.92	13.23	142.63	40.84	-0.812	0.420
Thickness of reticular dermis	386.10	8.24	483.27	116.43	-4.326	<0.001

*Mann-Whitney

Epidermis:

The thickness of epidermis at dermal papilla of females was significantly higher as compared to males. Stratum corneum of female palm was thicker as compared to males. Ratio of thickness of epidermis at dermal papilla and stratum corneum was found to be higher among females as compared to males. Female skin showed more cell layers in stratum spinosum and stratum granulosum. These values were statistically significant also. In none of the specimen stratum lucidum was clearly observed. [Table 1, Figure 1.1,1,2]

**Dermoepidermal Junction:**

Number of rete pegs was significantly higher in male palm as compared to female. As far as depth of rete pegs was concerned, in female palm these were significantly much deeper than males. [Table 1]

Dermis:

Papillary dermis of palmar skin did not show significant differences in its depth in both genders. Statistically significant values were observed for higher thickness of reticular dermis of male palm. [Table 1, Figure 1.1,1,2]

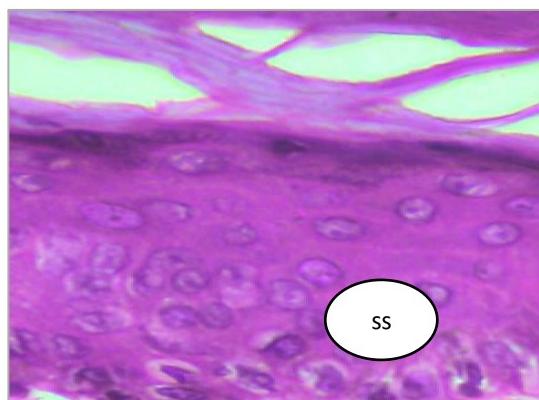
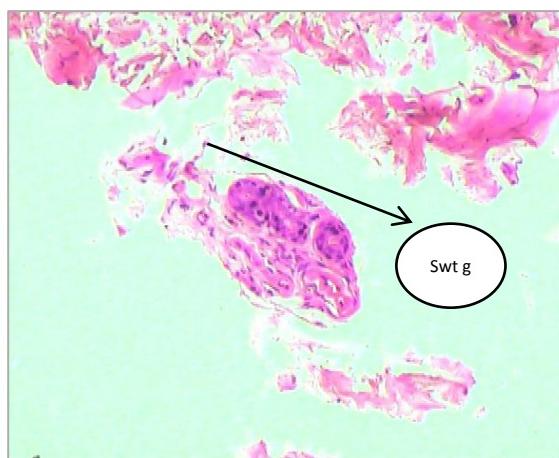
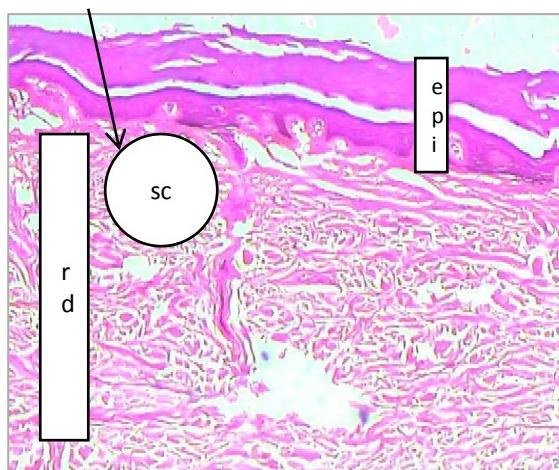


Figure 1.1: Stain: H&E. Microphotograph of palm of female showing epi, rd sc, swt g, ss in 4X, 10X & 40X respectively.

{Here epi-epidermis, rd- reticular dermis, sc-stratum corneum, swt g-sweat gland and ss- stratum spinosum}



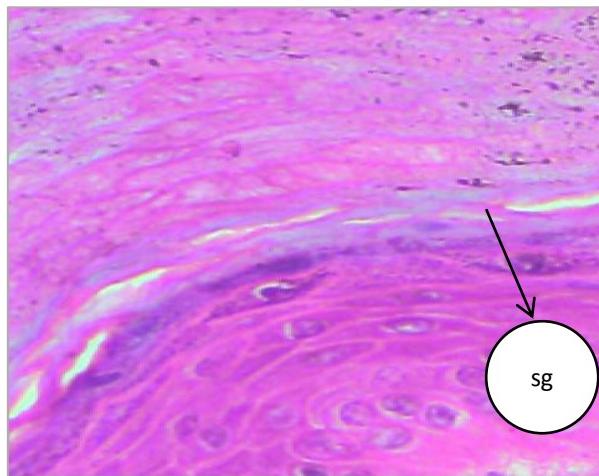


Figure 1.2: Stain:H&E .Microphotograph of palm of male showing epi,sc, rd, swt g & sg in 4X, 10X, & 40X respectively.

{Here epi-epidermis, rd- reticular dermis, sc-stratum corneum, swt g-sweat gland and ss- stratum spinosum.

DISCUSSION

The skin of palm has highest coefficient of friction as compare to dorsum of hand, anterior and posterior side of forearm, middle anterior and posterior leg.^[11] It has been also shown that frictional properties can reflect the chemical and physical properties of skin surface and thus depends on the physiological variations and pathological conditions of skin.^[12]

In the present study thickness of epidermis at dermal papilla, thickness of stratum corneum, SC/Edp ratio (proportion of stratum corneum to whole thickness), layers of stratum spinosum and stratum granulosum of non friction site of palm was significantly higher in females. It can be clearly appreciated that higher number of layers or number of keratinocytes in stratum spinosum and granulosum resulted in not only greater thickness of stratum corneum but also increased thickness of epidermis in females. Also, in females greater depth of rete pegs could have been responsible for contributing more number of basal keratinocytes and hence greater thickness of epidermis. Relatively, contribution of stratum corneum in total epidermal thickness was less in males. In males, there was greater number of rete peg suggesting better interlocking to avoid greater frictional forces but these were shallow in comparison to females. In contrast, thickness of both papillary as well as reticular dermis was more in males than females. So, disparity in thickness of epidermis and dermis

between genders suggest some regulation which is affected more than by mere its function [Table 1]. It is observed that collagen density and packing of fibrils in dermis is influenced by age as well as sex. With increasing age, skin collagen decreases more rapidly than skin thickness so collagen density decreases. Thickness of dermis is proportional to the collagen content and collagen density is less in females of all ages. Probably this could explain the reason for lesser thickness of female dermis than males in the present study.

Very little information on the microscopic topography of normal skin is available. Lee and Hwang reported the thickness of epidermis of palm and sole in Korean population in the range of 601-637 μm .^[13] Egawa M et al., found the thickness of stratum corneum of palm 173 μm which is lesser than the thickness of stratum corneum of palm of females but greater than males in the present study.^[14] These reports definitely highlights the racial variations of skin thickness and suggest the need to create a reference model for quantitative characteristics of healthy skin from various sites in different populations..

Gender differences in the various parameters of skin could be attributed to estrogen. Recently estrogen receptors are demonstrated in skin of mice. Shuster S et al., (1975) observed that the thickness of skin decreases in a linear manner in male as early as, at the age of 20 in contrast it remains constant in female till 50 years and then it decreases.^[15] Waller JM et al., (2005) stated that the thickness of epidermis decreases about 6.4% per decade on average whereas in postmenopausal women thickness decreases with much higher rate than men.^[16] McCallion Ret al., (1993) observed that the thickness of dermis decreases up to 20% in both male and female whereas de Rigal J (1989) mentioned in his study that thickness of dermis of sun unexposed sites decreases after 80 years.^[17,18]

CONCLUSION

Despite of the fact that subjects from both sexes belonged to the same age group, clear and statistically significant histological differences were observed in the skin of palm. Females showed thicker epidermis as well as stratum corneum but thinner dermis in comparison to males. Males had more number of rete pegs but these are shallower than females.

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How to cite this article: Dande K, Pankaj AK, Rani A, Chopra J, Rani A, Verma A. Gender Differences in the Microanatomy of Skin of Palm in Humans. Ann. Int. Med. Den. Res. 2019; 5(2):AT09-AT13.

Source of Support: Nil, **Conflict of Interest:** None declared